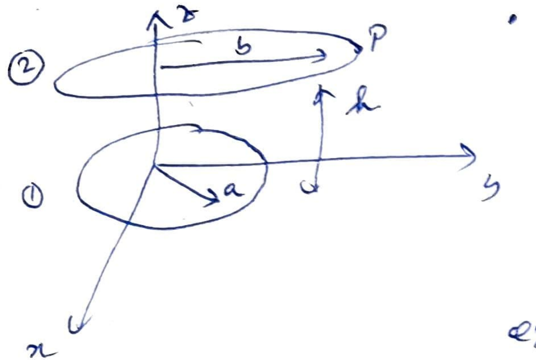
Assignment on Magnetostatics & Maxwell's Equations.

Coaxial circular loops:- $b = 2.5 \times a$, $h = \frac{a+b}{2}$.

Choose a = last 2 digits of roll no.

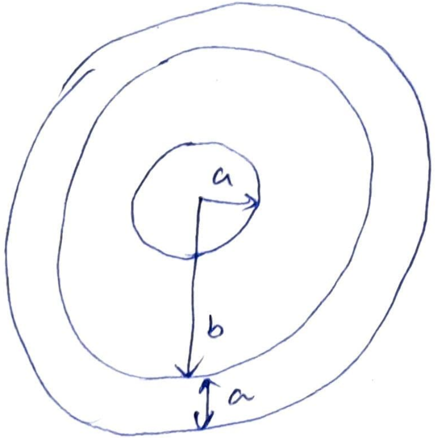


- Let I_1 current flow in wire-1, Compute the exact magnetic vector potential $\vec{A}$ at P on wire-2. Derive necessary expressions & mention the assumptions made in the notes.

Note here, you are to use computer to calculate the exact values without those assumptions.

- Compute the fields everywhere on the loop
- Compute ψ_{12} & the mutual inductance.
- Calculate the error difference (in percentage) with the exact values and the assumptions made in the notes.
- Compute the force between the two loops if they both carry 1 A current.

Coaxial - cable



Inner conductor radius 'a'. 'a' being the last 2 digits of roll no.

outer conductor from b to b+a, $b = 2.5 \times a$.

Conductivity σ (copper) – check from internet.

freq: = ~~500~~ 1 GHz.

- Compute the skin-depth (δ)
- Assume the current being limited to 3δ, compute $\vec{B}$ everywhere
- Compute L_{int} & L_{ext}.

Change the frequency to 10 GHz & 100 GHz and recalculate the values.

Compare the values with the case where freq approaches D.C.

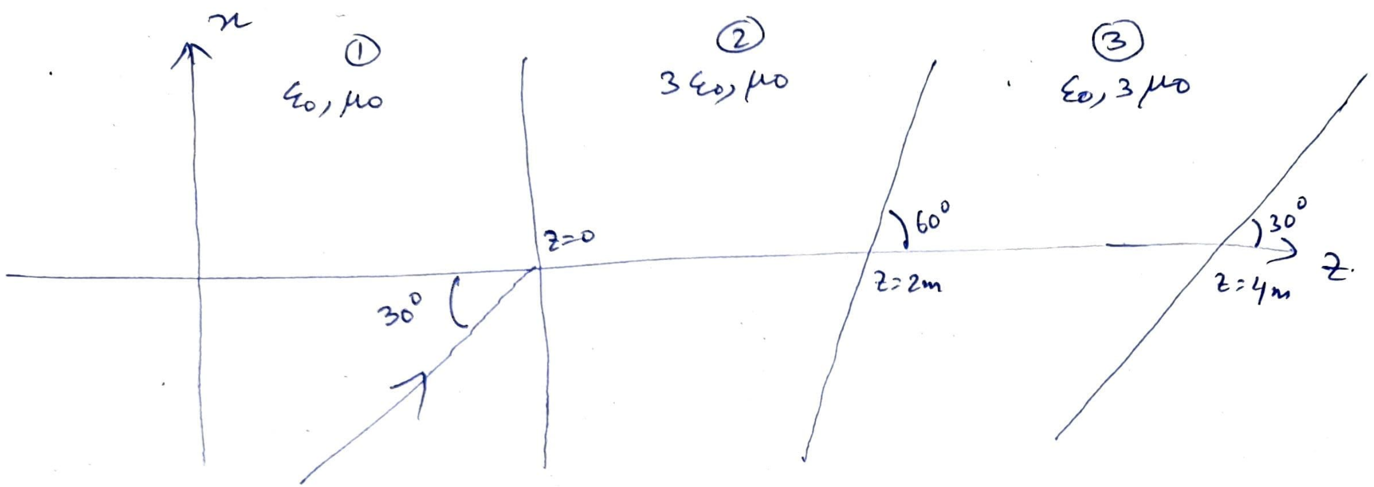
(3) • Write down the Maxwell's Equation in Phasor form. Explain what is phasor notation & why we need them.

• Derive the Poynting Equation from the above.

• Consider a wire of length 1mm., carrying current $3 \cos(2\pi f_0 t + 30^\circ)$, $f_0 = 1\,GHz$. Compute $\vec{A}$, $\vec{H}$, $\vec{E}$ & the poynting vector ($\vec{P}$). Derive the necessary equations used to compute the above.

(4) For a moving loop in a time varying $\vec{B}$, derive the emf induced. Construct an example to illustrate the emf induced. Show how two frequencies can be generated using the above scheme. Provide a practical application of the same.

(5)



- medium ① & ④ is free space
- Consider both parallel & perpendicular polarisation.

- A wave is incident at an angle 30° to an interface between medium ① & ②. Find $\vec{k}_{inc}$, $\vec{k}_{ref}$, $\vec{k}_{Tx}$ in ① & ②. & the corresponding fields.
- The transmitted field is incident at an interface held obliquely at an angle 60° between medium ② & ③. Find the new $\vec{k}_{ref}$, $\vec{k}_{Tx}$ in ② & ③ & the corresponding fields.
- The new transmitted field is incident at an interface held obliquely at an angle 30° between medium ③ & ④. Find the new $\vec{k}_{ref}$, $\vec{k}_{Tx}$ in ③ & ④ & the corresponding fields.

- What are the assumptions made in the above computations.